THE IDENTIFICATION OF CULTIVATED PLANTS. III.
CONFIRMATORY KEYS TO SOME WHEAT VARIETIES

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INTRODUCTION

In a previous article (Badawi et al, 1978) one set of identificatory keys to a sample of 52 wheat varieties from 3 species (Triticum durum Desf., T. vulgare Vill. and T. pyramidale Delile) has been given. These keys have been based on 26 characters recorded comparatively for each of the 52 varieties from gross vegetative morphology, features of the spikes and spikelets, kernel size and pollen diameter. However, the comparative recording of these characters enables the generation of numerous alternative keys to the same group of plants. Therefore, in this article we present another set of such keys in order that one set may be used in determining unknown wheat varieties while the other is used in the confirmation of that determination. The same idea has also been applied successfully to species and varieties of such economically important fiber-producing genera as Gossypium (El-Gazzar et al, 1975; Sallouma et al, 1975) and Linum (El-Gazzar et al, 1976; Momtaz et al, 1976), within the framework of a comprehensive project concerning the identification of cultivated plants.

Detailed descriptions of the 26 characters used as bases for the keys presented here, as well as their comparative scoring for each of the 52 wheat varieties represented in these keys will be found in Badawi et al (1978).

THE KEYS

For ease of manipulation the 52 wheat varieties have been divided into 6 smaller groups and a dichotomous non-indented key has been constructed for each group separately. The general policy adopted in the construction of these keys has previously been sketched (El-Gazzar, 1976). Furthermore, in order to save space in the keys, the full specific epithets have been replaced with the following

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symbols: D = Triticum durum Desf., V = T. vulgare Vill., and P = T. pyramidale Delile.

Key to groups I-VI

A. Glumes brown	group I
Glumes white-yellow	B.
B. Basal node not swollen	C.
Basal node swollen	D.
C. Stem with 3 internodes	group II
Stem with 4 or 5 internodes	group III
D. Stem with 3 internodes, less than 100 cm long	group IV
Stem with 4-7 internodes and at least 107 cm long	E.
E. Flag leaf with 39-41 veins	group V
Flag leaf with 59-82 veins	group VI

Group I (14 varieties)

1. Basal node not swollen	2.
Basal node swollen	4.
2. Stem white, lodging, with 3 internodes, spike oblong, pollen diameter 85 u	PM8-V
Stem purple, no lodging with 4 internodes, spike fusiform, pollen diameter 56 u	3.
3. Awn 12 cm long, toothed, spike drooping, stem 85 cm long, flag leaf 26 cm long, 87-veined, glume peak 0.6 mm long	Duker 7-D
Awn 6.5 cm long, toothless, spike erect, stem 105 cm long, flag leaf 18 cm long, 46-veined, glume peak 4 mm long	Mabrouk-V
4. Awn 6.5 cm long	5.
Awn at least twice as long	6.
5. Awn dark-coloured, toothed, stem 90 cm long with 3 internodes, pollen diameter 80 u.	PM14-V
Awn white-yellow, toothless, stem 110 cm long with 5 internodes, pollen 56 u in diameter	montana-V
6. Stem at least 110 cm long, terminal internode 20-23 cm long	7.
Stem 84-93 cm long, terminal internode 12-18 cm long	10.
7. Stem lodging, awn toothless	8.
Stem not lodging, awn toothed	9.
8. Spike fusiform, curved, glume apex obtuse, flag leaf 46-veined	Duker 49-D
Spike oblong, erect, glume apex acute, flag leaf 59-veined	Duker 52-D
9. Stem white, spike oblong, lax, erect, kernel yellow, basal internode 9 cm long	Duker 13-D
Stem purple, spike fusiform, dense, curved, kernel amber brown, basal	

internode twice as long . . . . . .L64 skevart-D
10. Flag leaf with 56-60 veins . . . . . 11.
Flag leaf with 77-78 veins . . . . . 13.
11. Stem white . . . . . 12.
Stem purple . . . . . Duker 10-D
12. Spike dense, terminal internode 12 cm long, awn 18 cm long, glume apex 2 mm long, flag leaf 34 cm long . . . . . Duker 11-D
Spike lax, terminal internode 17 cm long, awn 14 cm long, glume apex 0.5 mm long, flag leaf 29 cm long . . . . . Duker 14-D
13. Kernel amber yellow, awn 12 cm long . . . Duker 12-D
Kernel amber brown, awn 17 cm long . . . . Duker 15-D

Group II (9 varieties)

1. Stem not lodging, awn toothless, basal internode 9-11 cm long . . . . . 2.
Stem lodging, awn toothed, basal internode 3.7-7.5 cm long . . . . . 3.
2. Spike oblong, lax, erect, stem 95 cm long, flag leaf 50-veined, glumes 6.5x4 mm, pollen diameter 48 u . . . . . .giorgiop-I -D
Spike fusiform, dense, curved, stem 70 cm long, flag leaf 71-veined, glumes 9x3.1 mm, pollen twice as large. . . inia 66-V
3. Spike oblong, flag leaf at least 28 cm long . . . . . 4.
Spike fusiform, flag leaf 18-21 cm long . . 5.
4. Spike curved, glumes acuminate, awn 5.5 cm long . . . . . .chenob 70-V
Spike erect, glumes acute, awn 8 cm long. .kushal 69-V
5. Basal internode 7.5 cm long, size of 100 kernels 26 cc PM12-V
Basal internode 3.7-5 cm long, size of 100 kernels 28-29 cc . . . . . 6.
6. Awns dark, spike erect . . . . . .blue silver-V
Awn white-yellow, spike drooping . . . . . 7.
7. Kernel brown, glume apex acute, pollen 48 u in diameter PM2R-V
Kernel amber yellow, glume apex acuminate, pollen diameter 64 u . . . . . 8.
8. Stem purple, awn 6.5 cm long, flag leaf 75-veined PM2B-V
Stem white, awn 9 cm long, flag leaf 50-veined PM4-V

Group III (7 varieties)

1. Stem 64-90 cm long, terminal internode 13-14 cm long, basal internode 7-8 cm long. 2.
Stem 104-157 cm long, terminal internode 19-26 cm long, basal one 11-17 cm long. . . 4.

2. Stem purple, awn toothless . . . . . Bajio 67-V
   Stem white, awn toothed . . . . . 3.
3. Spike dense, drooping, kernel brown, awn 8.5 cm long, flag leaf 67-veined . . . Duker 6-D
   Spike lax, erect, kernel yellow, awn 14 cm long, flag leaf 52-veined . . . . . Duker 9-D
4. Awn 6.5 cm long . . . . . 5.
   Awn 11.5 cm long or more . . . . . 6.
5. Spike oblong, terminal internode 26 cm long, flag leaf 71-veined Africa mayo composite III-V
   Spike fusiform, terminal internode 19 cm long, flag leaf 46-veined. .Africa mayo composite IV-V
6. Stem purple, 157 cm long, spike oblong, awn toothed, kernel amber yellow, flag leaf 31 cm long, 55-veined, glumes 9x2 mm. Duker 4-D
   Stem white, 115 cm long, spike fusiform, awn toothless, kernel amber brown, flag leaf 20 cm long, 38-veined, glumes 6x4 mm. Duker 5-D

Group IV (6 varieties)

1. Kernel brown . . . . . 2.
   Kernel yellow or amber yellow . . . . . 4.
2. Spike lax PM11-V
   Spike dense . . . . . 3.
3. Spike oblong, curved, flag leaf 30 cm long, 50-veined, glume apex 3 mm long. . . snova 64-V
   Spike fusiform, erect, flag leaf 37 cm long, 62-veined, glume apex twice as long. PM9-V
4. Stem white, 60 cm long, terminal internode 10.5 cm long, basal 5 cm long, spike fusiform, size of 100 kernels 27 cc. mag 54-V
   Stem purple, 95-100 cm long, terminal internode 16 cm long, basal at least 9 cm long, spike oblong, size of 100 kernels 29 cc . . . . . 5.
5. Stem not lodging, awn toothed, 7.5 cm long, glume apex 7 mm long . . . . . Giza 150-V
   Stem lodging, awn toothless, twice as long, glume apex 0.5 mm long . . . . . .baladi 116-P

Group V (3 varieties)

1. Spike dense, erect . . . . . Giza 145-V
   Spike lax, curved . . . . . 2.
2. Stem purple, 155 cm long, spike fusiform, awn toothed, glume apex 5 mm long . . . . Duker 3-D
   Stem white, 115 cm long, spike oblong, awn toothless, glume apex 2 mm long . . . . . improved mokhtar-V

Group VI (13 varieties)

1. Stem white . . . . . 2.
   Stem purple . . . . . 6.
2. Stem at least 170 cm long, with 6-7 internodes, terminal 30-32 cm long, basal 25-26 cm long . . . . . 3.
   Stem 116-135 cm long, with 4-5 internodes, terminal 20-25 cm long, basal 11-16.5 cm long . . . . . 4.
3. Flag leaf 65-veined . . . . . arotha-D
   Flag leaf 82-veined . . . . . mindom-D
4. Stem lodging, awn 12 cm long, glume apex 1 mm long . . . . . ACME-D
   Stem not lodging, awn 17-20 cm long, glume apex 4-5 mm long . . . . . 5.
5. Awn toothed, kernel amber yellow, flag leaf 70-veined, pollen diameter 56 u . . seven stars-V
   Awn toothless, kernel brown, flag leaf 59-veined, pollen diameter 80 u . . inia 156-V
6. Stem lodging, glumes 10 mm long, acute . 7.
   Stem not lodging, glumes 7.5-9 mm long, acuminate (except in Duker 8). . . 8.
7. Spike fusiform, stem 135 cm long, terminal internode 25 cm long, basal 16 cm long, awn 15 cm long, flag leaf 78-veined . . . . . spelemer-D
   Spike oblong, stem 160 cm long, terminal internode more than 29 cm long, basal 23 cm long, awn 9 cm long, flag leaf 61-veined . . . . . kubanka-D
8. Spike dense, awn 7-10 cm long, flag leaf with 61-63 veins . . . . . 9.
   Spike lax, awn at least 11 cm long, flag leaf with 71 veins or more. . . . . 11.
9. Awn toothed, stem 137 cm long, basal internode 17.5 cm long, spike curved . . MD 474-V
   Awn toothless, stem 107-115 cm long, basal internode 9-10.5 cm long, spike erect . . . . . 10.
10. Stem with 5 internodes, flag leaf 23 cm long . . . . . Giza 144-V
    Stem with 4 internodes, flag leaf 30 cm long . . . . . Giza 148-V
11. Spike oblong, glume apex obtuse, stem 139 cm long . . . . . Duker 8-D
    Spike fusiform, glume apex acuminate, stem 115-125 cm long . . . . . 12.
12. Spike curved, terminal internode 27 cm long, basal 16 cm long, flag leaf 38.5 cm long . . . . . Duker 1-D
    Spike erect, terminal internode 16 cm, basal 10 cm, flag leaf 26 cm long . . . Duker 2-D

DISCUSSION

We have endeavoured to separate the two entries of each couplet in the keys using combinations of as many correlated characters as possible in order to give maximum contrast between them, thus facilitating the users' task of deciding to which of them an unknown wheat variety belongs. Nevertheless, in case the keys constructed so far may have not made the best possible use of the characters recorded comparatively for the plants, the data-matrix on which they are based (Appendix I in Badawi et al, 1978) should serve as a permanent record of the plants and their characters, enabling those interested in wheat identification to generate their own keys on the basis of the same set of characters. This data-matrix has the added merit of being easily expandable in one or both directions; i.e. it can accomodate more plants, more characters, or both, and as such it also serves as an information storage-retrieval system in which new plants can be pigeon-holed.

It can be observed from the keys that we have avoided some of the common pit-falls found in other keys. For instance, the characters or combinations of characters chosen to distinguish between the various division levels in the keys are such that each variety appears only once in these keys. One of the usual features of most keys to date is that a given taxon can be keyed out at more than one place in the same key. This is a result of diagnosing the various couplets including this taxon by characters represented by more than one state in its members. No such repetition will be found in our keys to wheat varities. Furthermore, ambiguous and unqualified character definition such as 'stem long / stem short' (without any idication of how long is long or how short is short), has been eliminated entirely from our procedures. Instead, actual measurements of the various parts of the plants have been recorded, and only those with the widest possible margin of difference have been used in the distinction between the two alternative entries of a given couplet.

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